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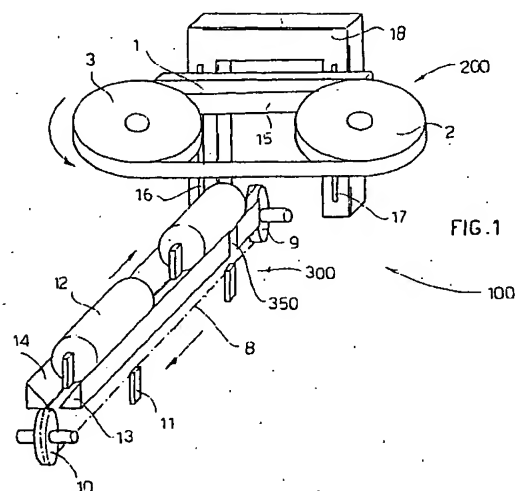
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(54) Band saw for continuous cutting of logs of web material

(57) A band saw for cutting rolls or logs (12) of web material, such as paper or the like, comprises a cutting assembly (200) to which the logs (12) are fed by means of a conveyor assembly (300); the cutting assembly (200) comprises a pair of flywheels (3, 4) on which runs a cutting band (1) that can be brought into engagement with said log (12), moving vertically with a reciprocating movement from top to bottom and vice versa; the conveyor assembly (300) travels in a single direction to feed the logs (12) continuously toward the cutting assembly (200).



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Description

[0001] The present invention refers to a band saw for cutting rolls or logs of web material, particularly suitable to be included in a continuous production process.

[0002] Reference will be made herein to logs of paper, but it is obvious that the invention applies to any web material, such as plastic, laminates and the like.

[0003] At present there are limits and problems in rewinding of logs of paper with a large diameter, more than 400 mm, for example, obtained by unwinding large logs of material. The problems principally concern cutting of the logs obtained, if they are wound onto a long tubular core.

[0004] For cutting logs with diameters of less than 400 mm, use is normally made of disc shears which are economically and technically unsuitable for logs with a larger diameter. In fact a disc blade is very expensive and subject to frequent breakage and replacement and, since it must continually be sharpened, it wears quickly and can no longer cut logs with a large diameter.

[0005] To overcome these problems band saws similar to those used for cutting ferrous materials have been proposed, comprising a heavy base, carrying the flywheels and the cutting band, pivotally mounted, driven by hydraulic cylinders. Such a type of saw is extremely complex, difficult to maintain and slow in operation.

[0006] These problems are solved, at least in part, by band saws whose cutting blade is made to advance horizontally toward the logs to be cut conveyed by a conveyor driven by a chain wound on wheels.

[0007] In order to perform complete cutting of the log of paper it is necessary for the idle wheel of the conveyor chain to be placed upstream of the cutting area. In these conditions, in order to keep the cutting blade as near as possible to the idle wheel and thus avoid having an excessively long trimming, that is the final scrap of the log, it is necessary for the conveyor to reverse its movement in order to be able to load a second log. Otherwise, the pusher arm of the log, or slave would come to interfere with the cutting area immediately downstream of the idle wheel, unless very complex and costly arrangements are adopted. The types of conveyors used therefore have a reciprocating motion.

[0008] As a result, a new log cannot be loaded while the previous log is being cut. The conveyor therefore moves with a reciprocating movement. Consequently, the system is rather slow.

[0009] The object of the invention is to remove these drawbacks, providing a band saw for cutting logs with large diameters, for example from 240 to 520 mm, which is extremely fast, versatile and suitable for a continuous production process.

[0010] This object is achieved according to the invention by means of the characteristics listed in appended independent claim 1.

[0011] Preferred embodiments of the invention are

apparent from the dependent claims.

[0012] In the band saw according to the invention provision is made for the cutting band, which works in an intermediate area of a continuous conveyor, to be made to advance vertically toward the logs to be cut. Use of a continuous conveyor means that loading of a new log can take place even during the period in which the previous log is being cut by the steel band.

[0013] The feed system is therefore designed so that the cutting band does not interfere with the conveyor. In particular, a vertical slot is provided in the supporting guide of the log to allow passage of the cutting blade.

[0014] Means for holding the log of paper still during cutting are provided. Once cutting has been carried out said means cause the log to withdraw slightly, so as to ensure the return of the cutting blade.

[0015] The band saw according to the invention can work in a considerably shorter cycle time with respect to the band saws of the prior art, thanks in particular to the fact that the log conveyor advances continuously without making the to and fro movements of the reciprocating conveyors of the prior art.

[0016] Further characteristics of the invention will be made clearer by the detailed description that follows, referring to a purely exemplary and therefore non-limiting embodiment thereof illustrated in the appended drawings, in which:

Figure 1 is a diagrammatic axonometric view of a band saw and a conveyor assembly for feeding logs according to the invention;

Figure 2 is a diagrammatic side elevation view of the band saw in Figure 1;

Figure 2a is a diagrammatic view of the cutting assembly, in the direction of the arrow A in Figure 2;

Figure 2b is a diagrammatic view of the cutting assembly, in the direction of the arrow B in Figure 2;

Figure 2c is an enlarged diagrammatic view of a part of the drive system of the cutting assembly enclosed in the oval C in Figure 2;

Figure 3 is a diagrammatic front elevation of the log conveying assembly;

Figure 3a is a diagrammatic side elevation of the log conveying assembly;

Figures 4a-4d are diagrammatic views illustrating the cutting blade and the log to be cut in successive work stages;

Figure 5 is a diagrammatic side view of the band saw with the cutting assembly at top dead centre;

Figure 5a is a diagrammatic side view of the band saw with the cutting assembly at bottom dead centre;

Figure 6 shows a partially cutaway side view of the log conveying assembly, diagrammatically illustrating a device for blocking the log of paper during cutting;

Figure 7 is a diagrammatic view, in the direction of the arrow D in Figure 6.

[0017] Figure 1 shows a band saw according to the invention, denoted as a whole by reference numeral 100, comprising a cutting assembly 200, to which the rolls of paper or logs 12 are fed by means of a conveyor assembly 300.

[0018] As shown in Figures 2a and 2b, the cutting assembly 200 comprises a cutting tool 1, normally consisting of a steel band about 1.2 mm thick and 60 mm wide, the side of which is suitably chamfered to form a cutting edge 1'.

[0019] The band 1 is wound on two flywheels 2 and 3, the flywheel 3 being motorized by an electric or hydraulic motor 4 (Figure 2b), by means of a cogged belt transmission 5.

[0020] The flywheel 2, on the other hand, is mounted idle on a sliding support 6 controlled by a hydraulic piston 75 so as to have the band 1 constantly under tension.

[0021] Figures 3 and 3a show the conveyor assembly 300 for feeding the logs of paper 12 to the cutting assembly 200. The conveyor assembly 300 comprises a horizontal conveyor 8 formed by a chain or conveyor belt that winds on two wheels or rollers 9 and 10, the roller 10 being motorized. Pusher arms 11, commonly called slaves are secured to the chain 8. Said pusher arms 11 are positioned at a sufficient distance to be able to receive a log of paper for cutting between one pusher arm and the other. The logs of paper 12, pushed by the pusher arms 11, are made to slide on two longitudinal guide surfaces 13 and 14 disposed obliquely to form a V-shaped support as shown in Figure 3. The guide surfaces 13 and 14 have two aligned slits respectively at the side of the cutting assembly 200 to allow passage of the cutting band 1, one of which slits 350 in the guide surface 13 is visible in Figure 1.

[0022] The conveyor 8 is provided with intermittent pulse movement synchronized with the movement of the cutting assembly 200. The step length of the conveyor 8 is equal to the desired cutting length of the log 12.

[0023] Loading of a log of paper 12 on the conveyor 8 can also be carried out during the time in which the preceding log is cut by the steel band 1. This is possible by virtue of the fact that the pusher arms 11 can rotate on the cogged wheels 9 and 10 integrally with the chain 8 and do not interfere with the cutting band 1.

[0024] The drive system of the cutting assembly 200 is described with reference to Figures 2 and 2c.

[0025] The flywheels 3 and 4 are supported by a single structure consisting of a frame 15 which can slide vertically on two linear guides 16 and 17 with balls or ball bearings. The guides 16 and 17 are supported by a load-bearing portal 18. The flywheels 3 and 4 are mounted so as to have their axis inclined by 60° with respect to the vertical.

[0026] As shown in Figure 2a the branch of the band 1 that makes the cut is bent by means of blade-guiding cylinders 19 so that it is disposed at right angles to the axis of the log to be cut and obviously parallel to the direction of travel of the flywheel frame 15. These blade-guiding cylinders 19 also serve to prevent bending of the band during cutting.

[0027] This flywheel configuration is such that the branch of the blade not involved in cutting does not interfere with the log of paper, so as to be able to make cuts of any length.

[0028] A sharpening device 20 consisting of two grinding wheel assemblies driven by air turbines is mounted on the frame 15 that supports the flywheels, on the side of the branch of the band not involved in cutting. In this manner it is possible to carry out sharpening of the band 1 even when said band is cutting.

[0029] The flywheel supporting frame 15 is driven with a reciprocating vertical movement by means of a screw 21 and nut-screw 22 assembly (Figure 2c) with planetary rollers. The screw 21 is secured rigidly to the frame 15 to be driven and the nut-screw 22 is keyed into a bushing 23 which in turn is mounted by means of rolling-contact bearings 60 in a fixed support 24 integral with the load-bearing portal 18.

[0030] As shown in particular in Figure 2, keyed onto the bushing 23 is a cogged pulley 25 on which is wound a cogged belt 26 which transmits the power necessary to drive the flywheel bearing frame 15, provided with an electric motor 27. The speed of the motor 27 can be controlled electronically so as to be able to drive the flywheel bearing frame 15 with reciprocating motion at controlled speed, stroke and acceleration/deceleration.

[0031] The cutting assembly 200 makes a vertical forward stroke toward the log 12 to be cut, which is conveyed by the conveyor assembly 300; thus the top dead center or end of stroke position can be regulated, as shown in Figure 5, according to the diameter of the log of paper to be cut.

[0032] Figures 4a-4d show the kinematic motion of the cutting process.

[0033] When the flywheel bearing frame 15 is at top dead centre (Figure 4a) the conveyor 8 causes the log 12 (Figures 4b and 5) to advance in the direction of the arrow F1, for a stroke equal to the length L of the cut to be made. The flywheel carrying frame 15 is then lowered in the direction of the arrow F2 (Figure 4c) until it reaches the bottom dead center of its stroke (Figure

5a), allowing the band 1 to make the cut. In this manner the log 12 above the conveyor 8 is cut into two pieces 12' and 12''.

[0034] During cutting, the log 12 is held still by a locking device 150 shown in Figures 6 and 7. The locking device 150 comprises two pressure assemblies 151 and 152, formed respectively by a frame ending in respective plates 160, 161 shaped with a concave shape to be able to compress the surface of the log to be cut. The pressure assemblies 151 and 152 are operated respectively by two pneumatic pistons 153 and 154 that push the plates 160, 161 vertically onto the log of paper. A sufficient gap 155 is left between the two pressure assemblies to allow the passage of the cutting band 1.

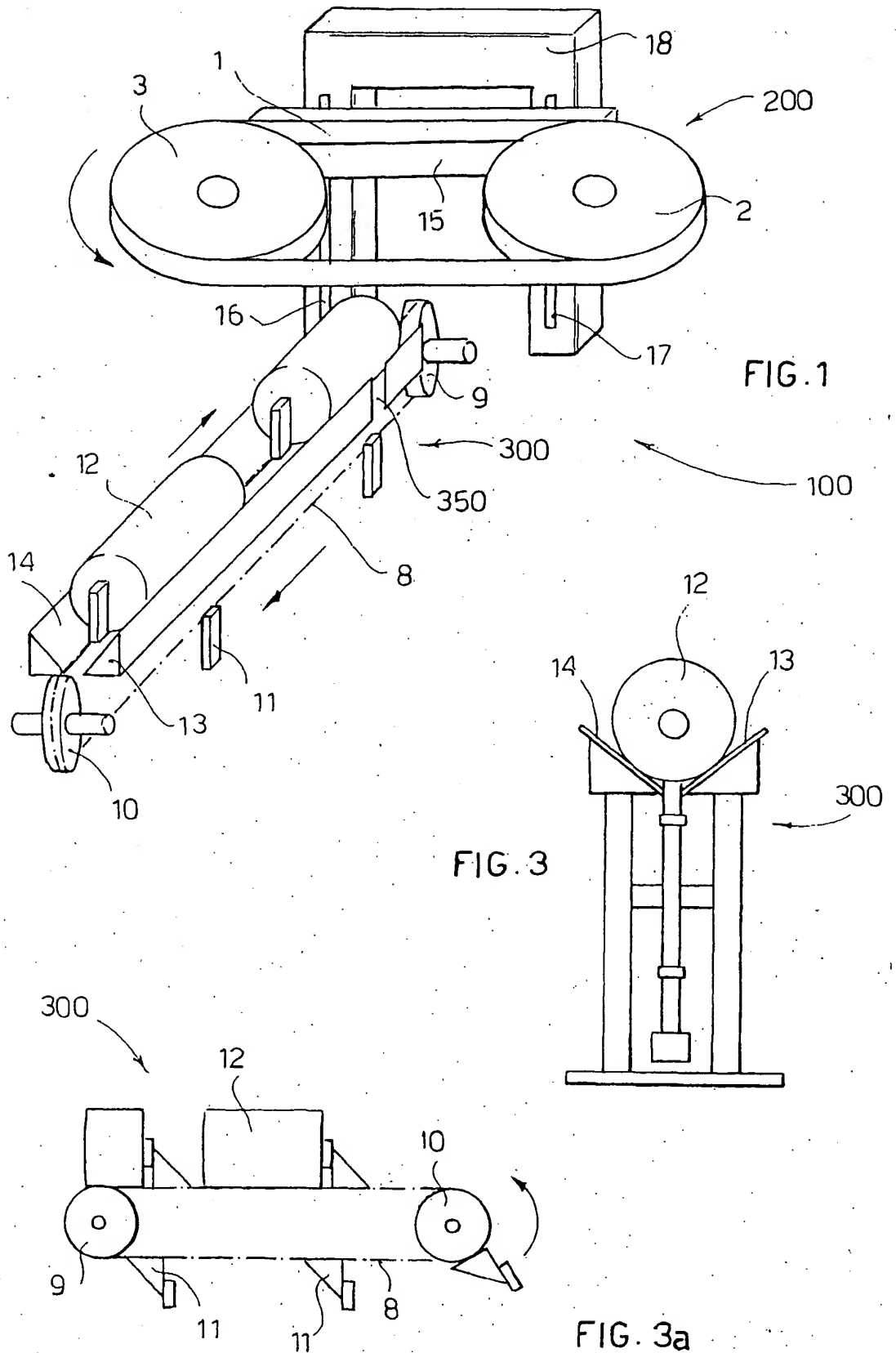
[0035] The pressure assembly 152 can slide horizontally on two linear guides 156 parallel to the conveyor 8. The horizontal movement of the pressure assembly parallel to the conveyor 8 is controlled by a pneumatic piston 157.

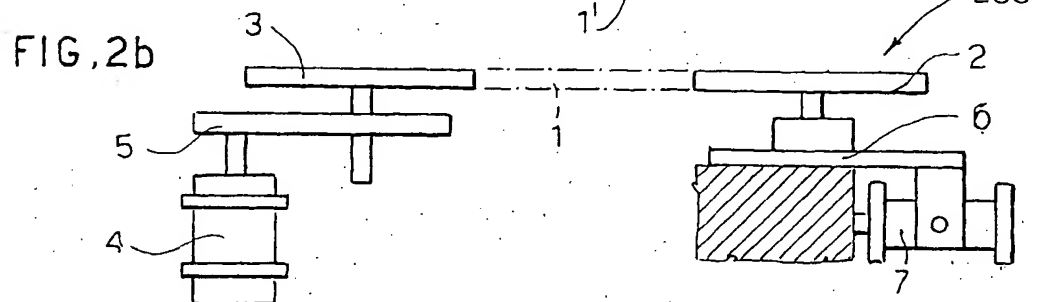
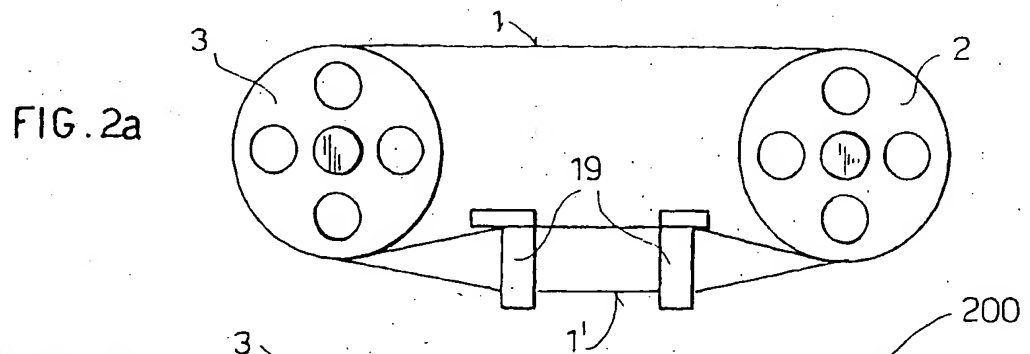
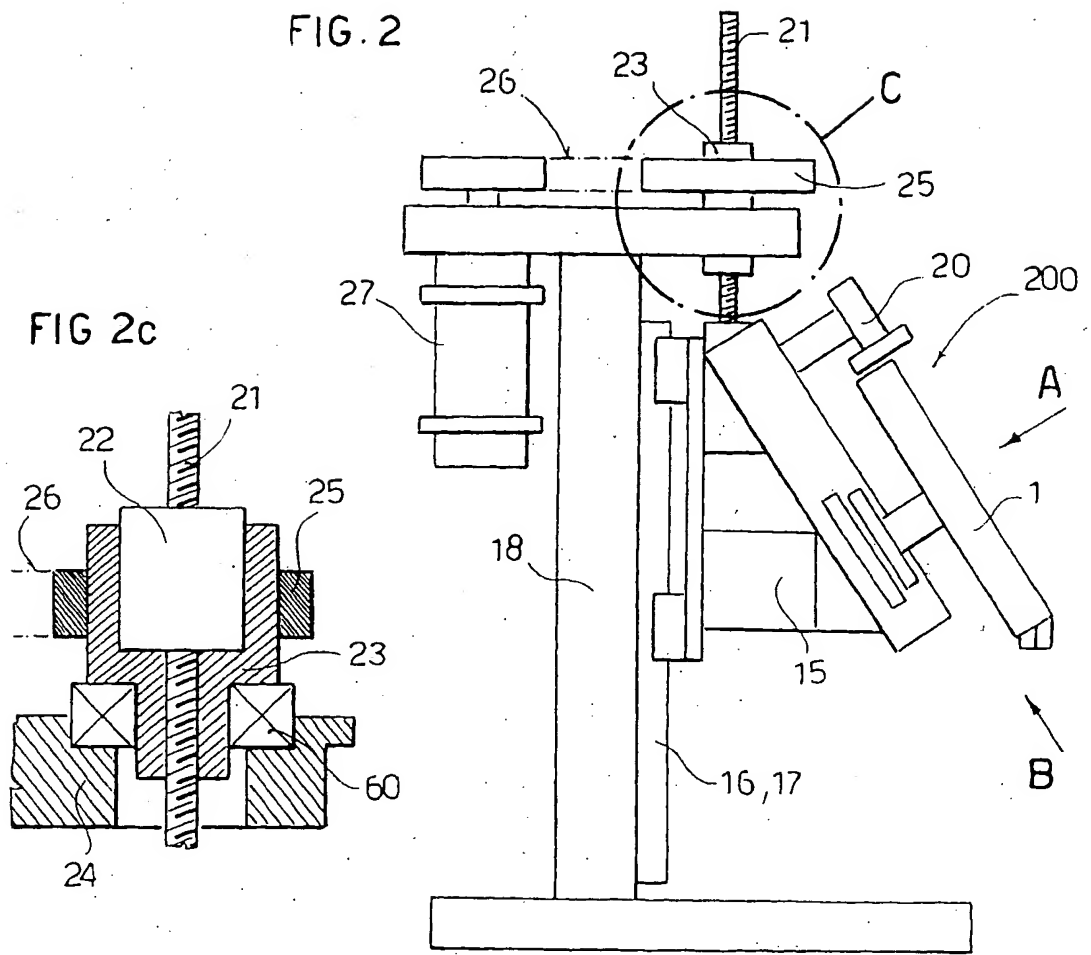
[0036] Once cutting of the log 12 has been carried out, the piston 157 is operated which allows the pressure assembly 152 to slide a few millimetres on the guides 156. This sliding takes place in the opposite direction to the direction of travel of the logs, in order to move the cut piece 12'' of log in the direction of the arrow F3 (Figure 4d). In this manner the cutting band 1 is allowed to rise again in the direction of the arrow F4 without interfering with the log of paper. This horizontal movement of the pressure roller 152 is synchronized with the motor of the conveyor 8 that controls a withdrawal of the pusher arms 11 of the same entity.

[0037] Once cutting of the log has been performed the blade can rise again freely beginning the return stroke. Finally the cut part 12' of the log will be removed by means of a *per se* known discharge device.

Claims

1. A band saw for cutting of rolls or logs (12) of web material such as paper and the like, comprising a cutting assembly (200) to which said logs (12) are fed by means of a conveyor assembly (300), the cutting assembly (200) comprising a pair of flywheels (3, 4), on which slides a cutting band (1) that can be brought into engagement with said log (12), characterized in that said cutting assembly (200) is vertically moveable with a reciprocating movement from top to bottom and vice versa and said conveyor assembly (300) has a one-way feed toward said cutting assembly (200), the cutting band (1) being disposed in the space occupied in a plan view by said conveyor assembly (300).
2. A band saw according to claim 1, characterized in that said flywheels (3 and 4) are supported by a frame (15) that can slide substantially vertically, in a direction at right angles to the axis of the log (12) to be cut.
3. A band saw according to claim 2, characterized in that the axis of said flywheels (3 and 4) is inclined with respect to the axis of sliding of said frame (15), cutting of the log being performed with the branch of the band (1) disposed in the foremost position.
4. A band saw according to claim 3, characterized in that provided on said branch of the band (1) that performs cutting are blade guiding cylinders (19) such as to bring the plane of the blade perpendicular to the axis of the log (11) and avoid bending of the blade during cutting.
5. A band saw according to any one of the preceding claims, characterized in that on said frame (15) on the side of the band not involved in cutting, band sharpening assemblies (20) are provided such as to sharpen the band (1) even during the period in which it is involved in cutting.
6. A band saw according to claim 2, characterized in that a screw (21) and screw nut (22) system is provided for vertical translation of said frame (15).
7. A band saw according to any one of the preceding claims, characterized in that said conveyor assembly (300) comprises a horizontal conveyor (8) that winds on two end wheels (9, 10) at least one of which is motorized to allow a continuous movement of the conveyor (8).
8. A band saw according to claim 7, characterized in that a locking device (150) is provided to hold the log (12) still on the conveyor (8) during cutting, comprising two pressure rollers (151, 152) spaced apart from each other by a gap (15) such as to allow the passage of the cutting band (1).
9. A band saw according to claim 8, characterized in that at least one (152) of said pressure rollers can slide horizontally, to control a slight withdrawal of the log after cutting of the log and to allow the cutting band (1) to rise again.





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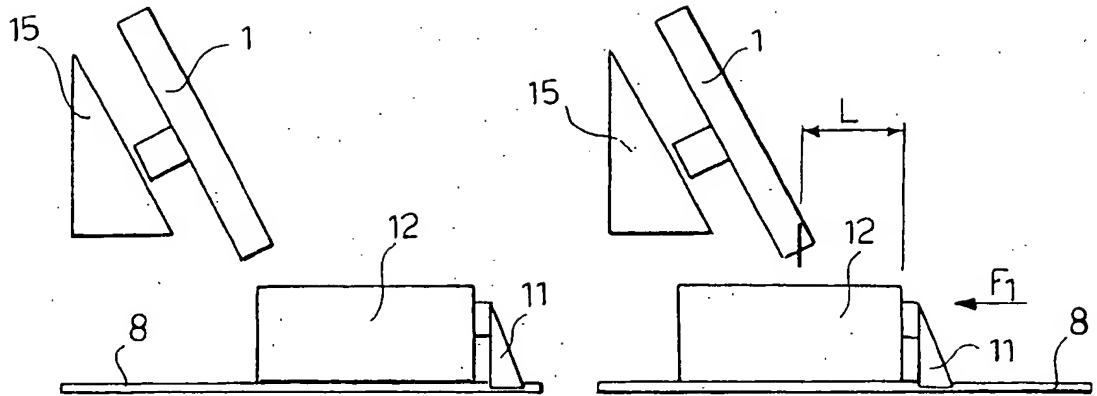


FIG. 4a

FIG. 4b

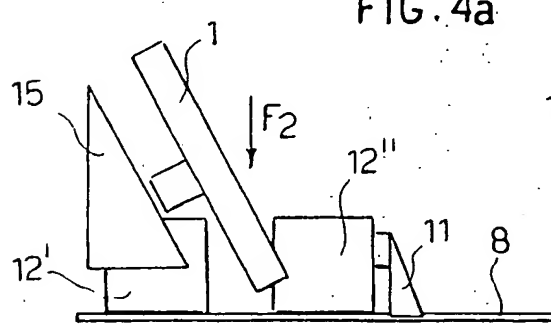


FIG. 4c

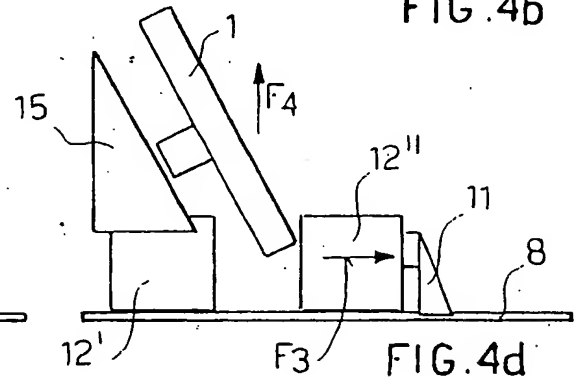


FIG. 4d

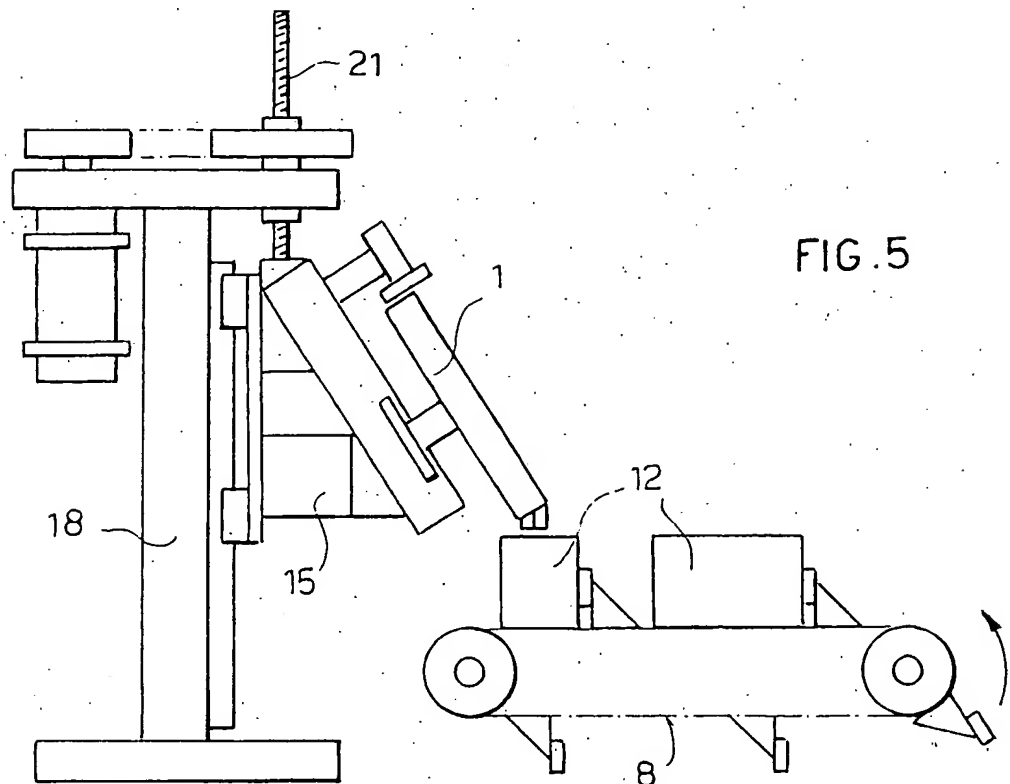
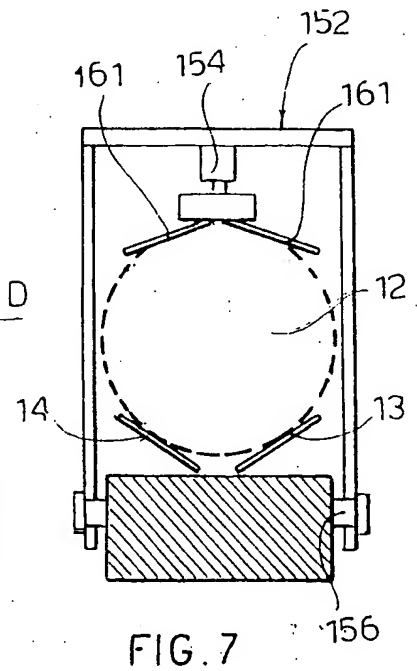
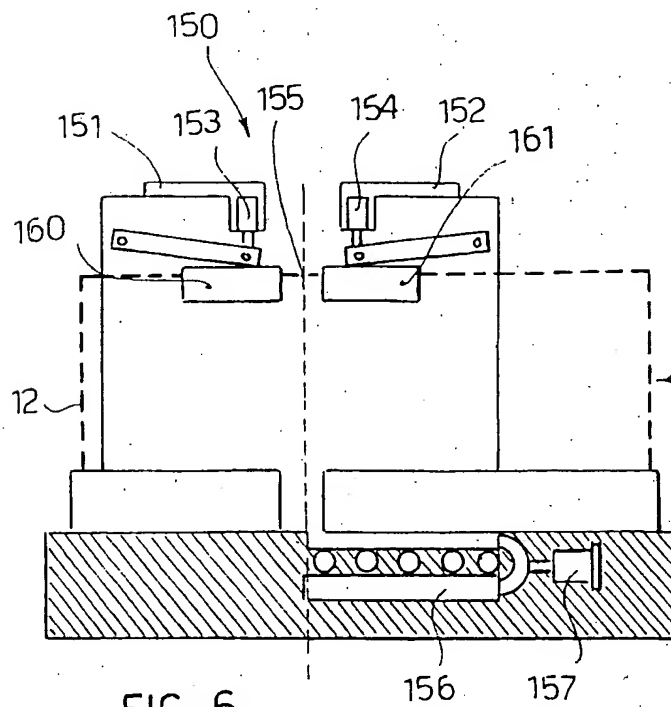
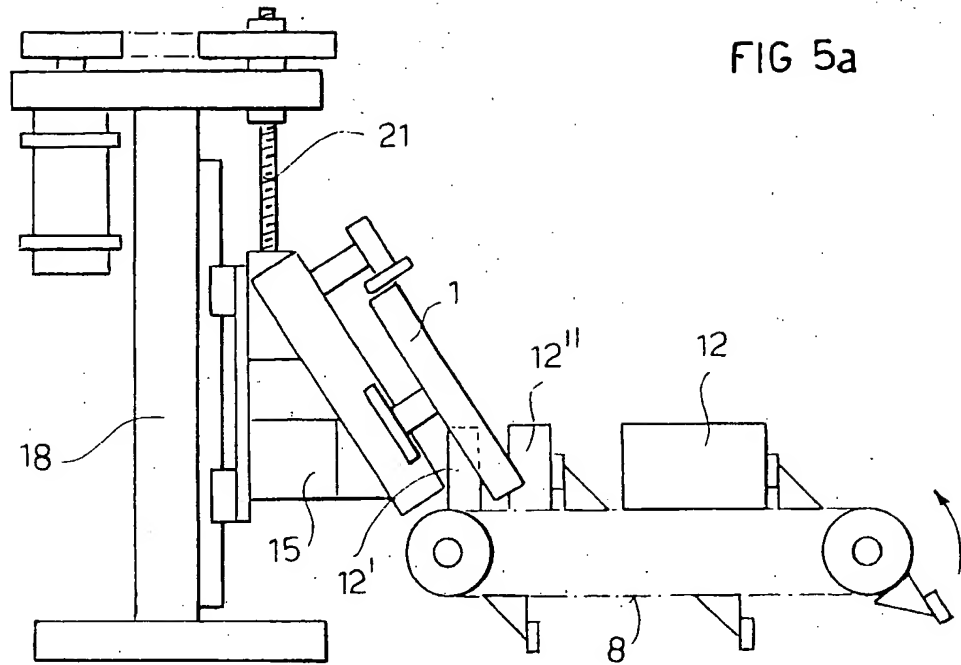


FIG. 5



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